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U N I C O R D E R  
U - 2 2 8 ( 5 0 0 )

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SPECIFICATION

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Specifications are subject to change without notice.

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## 1. OUTLINE

PANTOS Model U-228 Desk-top Automatic zero balancing DC-servo Recorder is a device to continuously record waveform corresponding to input signal on chart paper which moves at a constant speed by pens which are automatically balanced by means of servo system; a method known as a self-balancing method or so called zero method. Based on years of our experience, U-228 recorder was developed giving emphasis on substantial specifications and improved performance and versatility in operation in addition to consideration on style as well as compactness and light weight. As a result, this recorder has many outstanding features, as described in the following:

## 2. OUTSTANDING FEATURES

- (1) Power voltage can be easily changed among 5 voltage ranges so that U-228 is applicable to power voltages of every country in the world.
- (2) In addition of being compact and light weight, it is designed as being easily carried by one hand from one place to other wherever necessary.
- (3) Having an extended writing panel, the state of recording can be easily observed.
- (4) Having no obstacles on the right side of the writing panel, entry of data into the chart paper is easy.
- (5) Employing a pulse motor for chart drive, a great variety of chart speed selections as many as 24 steps and 23 speeds are freely available. Incorporating a tuning fork oscillator, stable and highly accurate driving speed are assured.  
In addition to externally starting and stopping, the chart paper can be driven in a speed proportional to the frequency of external signal source.
- (6) Equipped with a fast forward switch that makes the position correction of the chart paper easy.
- (7) Rewind switch allows the chart paper to be easily retracted to a desired position.
- (8) Because the chart take-up device is designed so as to be optionally built into the recorder without having to externally attaching it, only a minimum space is required for the operation (optional).

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- (9) Equipped with a chart paper end alarm, the end of the chart paper is notified by a buzz and a flashing lamp.
- (10) Using cartridge type fiber tip pens, such trouble as sudden "out of ink" cannot happen during the recording. The maintenance is easy, too.
- (11) The polarity of signal input can be changed by a switch.
  
- (12) An additional filter can be mounted for improving NMRR without impairing the characteristics of the recorder (optional).
- (13) Calibration of full scale can be easily achieved by a built-in DC calibrator.
- (14) Having a superimposed event marker as a standard feature, entries of marks can be made on any part of the chart. This feature is also helpful in knowing the recorded time lag between the pens.
- (15) The reliability is further improved by virtue of employing a torque reduction device for film potentiometer and DC servo motor.

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### 3. SPECIFICATIONS

Models	U-228(-500)
Number of Channels *1	1 or 2 (Please specify.)
Measuring System	Automatic Zero Balancing DC-servo
Writing width	250mm
Pen Speed *2	Less than 1/3sec
Zero Point	Right Zero of the chart paper.
Zero Set Range	+100% from right zero center.
Zero Point Check Switch	Provided
Measuring Range	1, 2, 5, 10, 20, 50, 100, 200, 500mV 1, 2, 5, 10, 20, 50, 100, 200V (17 ranges)
Fine Adjust for Measuring Range (Range Vernier)	*3 Provided.
Polarity Switch	Provided.
Input Impedance	1MΩ(constant)
Tolerable Signal Source Resistance	Less than 10kΩ
Accuracy *4	±0.3%(23°C) Temperature Coefficient; 0.025%/°C MAX.
Errors Between Ranges	2mV ~ 50mV Range : ±0.15%(23°C). Temperature Coefficient ; 0.005%/°C MAX. 0.1V ~ 200V Range : ±0.2%(23°C). Temperature Coefficient ; 0.0075%/°C MAX.
Dead Band	0.1%
Linearity	±0.25%

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Models	U-228(-500)	
Noise Rejection *5	CMRR	DC Over 160dB
		AC (50/60Hz) Over 160dB
	NMRR	AC (50/60Hz) 64dB TYP. (Pulse width; Over 50μ sec)
Temperature Characteristics *6	Zero drift upon introduction of power	Less than ±5μV (at constant room temperature)
	Zero drift upon stabilization	Less than ±1.5μV/10°C
Chart Speed	(1) 1, 1.5, 2, 3, 4, 6, 10, 15, 20, 30, 40, 60cm/min, cm/h *7 24 steps and 23 speeds (1cm/min and 60cm/h are overlapping) *8 (2) Chart Drive by External Signal: · Chart Speed: 1/60mm/Pulse (1mm/min at 1Hz, 600Hz max.) · Input Impedance: Over 4.7kΩ · External Power: Voltage: High Level; +2V ~ +20V Low Level; +0.8V ~ -20V (operable at TTL level) Signal Waveforms: Pulse, sine wave, square wave, triangular wave, etc. (Pulse width; Over 50μ sec)	
Chart Fast Forward Switch	Provided	
Chart End Alarm	Following actions take place when chart paper comes to an end: · Buzzer is sounded. · Chart drive is stopped. · Pen is stopped. · Lamp is flashed.	
Chart Rewind Device	Provided	

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Chart Paper	No.2516P50, 20m long, right zero		
Recording Pens	Cartridge Type Fiber Tip Pen		
Ink Colors	Channel 1: Red Channel 2: Green		
Pen Lift	Individually and manually operated (Distance between pens: 4mm)		
Torque Reduction Circuit	Provided *9		
Event Marker	Superimposing Amplitude: +3.5±1 graduation Time: 0.2 ~ 0.4 sec		
Event Marker Switch *10	Provided		
Calibration Voltage	Voltage: +1mV Accuracy: ±0.2% (23°C) Temperature Coefficient: 0.007%/°C		
Environment	Temperature: 0 ~ 45°C Humidity: 45 ~ 85%		
Power *11	Voltage Range	AC100, 115, 200, 220, 240V±10% (5 ranges)	
		Common for 50Hz and 60Hz.	
	Number of Channels	Power Consumption (TYP)	
		When Balanced	Max.
	1	19VA	32VA
2	21VA	47VA	
Insulation Resistance	Power-Chassis (GND) : Over 50MΩ (DC500V megger)		
	Input Terminal-Chassis(GND) : Over 100MΩ (DC500V megger)		

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Dielectric Strength	Power-Chassis (GND):	AC1000V for 1 minute
	Input Terminal- Chassis(GND)	: AC1000V for 1 minute
External Dimensions	430(W) × 123(H) × 354(D)mm	
Weight	Number of Channels	Weight
	1	7 kg
	2	8 kg
Accessories	Chart Paper No.2516P50	1
	Recording Pens	Number of Channels × 1
	Pulley Positioning Rod	1
	Fuses, 1A and 0.5A	1 each
	Dust Cover	1
	Instruction Manual	1
	Power Cord Adaptor	1

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[Notes]

- \*1 A short recording pen is for channel 1 and a long recording pen is for channel 2.
  - \*2 Time required for travelling 99% of input signal.
  - \*3 Each of the measuring ranges can be expanded up to 2.5 times.
  - \*4 · Value from measurement at maximum sensitivity range is shown.  
· Includes linearity.
  - \*5 Value from measurement at maximum sensitivity range is shown.  
When noise rejection is a special concern, both CMRR (AC) and NMRR can be improved as much as approx.  
30dB by using an additional input filter (optional).
  - \*6 Value from measurement at maximum sensitivity range is shown.  
· Warm-up time required for reaching at a stable condition is approx. 30 min.
  - \*7 Chart drive may be remotely operated. In this case, an external control terminal "CHART DRIVE" is used.
  - \*8 An external signal is applied to external control terminal "CHART OSC" upon setting chart speed unit selection switch on the panel to "EXT" position.
  - \*9 It is a device to protect DC servo motor when voltage exceeding the measuring range is applied frequently or for a long time.
  - \*10 External control is also possible. In such a case, an external control terminal "MARK" is used.
  - \*11 Applicable for 5 kinds of voltages by means of a voltage selector.
- Caution s 1 External operation terminal signal( Operation with TTL level signal is possible )  
High level ( +2 to + 20V )  
····· Chart paper sending ( Remote control ) → Stop, Event marker → OFF  
Low level ( +0.8 to - 20V )  
····· Chart paper sending ( Remote control ) → Stop, Event marker → OFF

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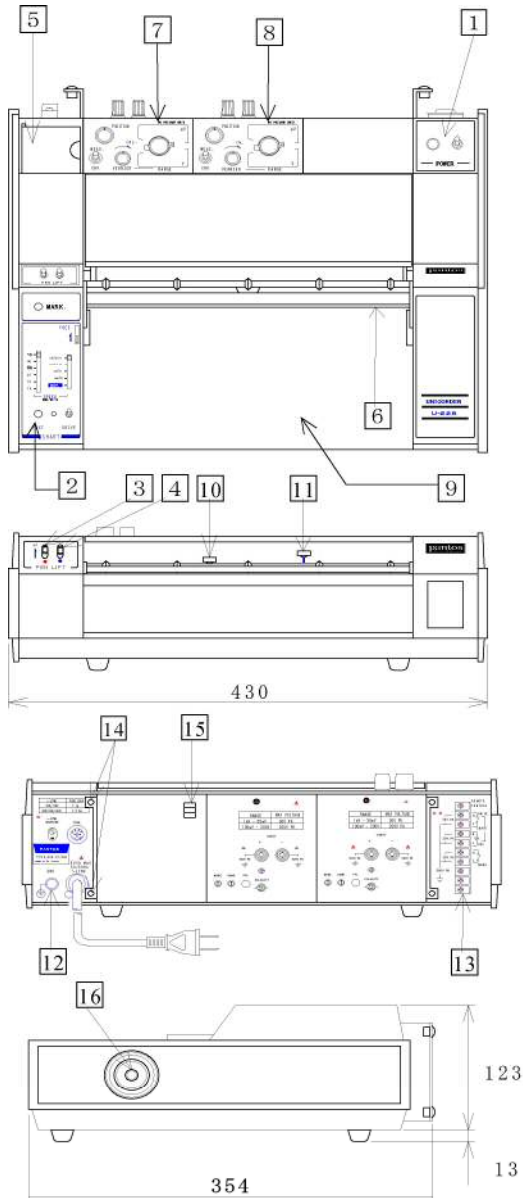
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#### 4. OPERATING PROCEDURE

##### 4.1 Descriptions and Functions of Parts:



Number	Name
1	Power Supply
2	Chart Drive Control Panel
3	Channel 1 Pen Lift Knob
4	Channel 2 Pen Lift Knob
5	Pen Box
6	Chart Paper Cutter
7	Channel 1 Amplifier Unit 1
8	Channel 2 Amplifier Unit 2
9	Writing Panel
10	Channel 1 Recording pen
11	Channel 2 Recording pen
12	Power Supply
13	External Control Terminal Strip
14	Cord Holder
15	Cord Clamper
16	Chart Rewind Knob

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